



Review

Effects of calcium intake on the cardiovascular system in postmenopausal women



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ABSTRACT

The use of calcium supplements for the prevention of complications of osteoporosis has significantly increased during the last years.

The effects of calcium intake in postmenopausal women on cardiovascular parameters such as blood pressure, serum lipids and cardiovascular events are controversial. Even though transient beneficial effects of calcium supplementation have been reported, especially in women with low dietary calcium intake, their long-term outcomes are inconclusive. Only a very few studies investigating serum lipids in postmenopausal women have been described and these showed significant increases in high-density lipoprotein and high-density lipoprotein to low-density lipoprotein ratio. With regards to cardiovascular events in this population group adverse effects have been reported on the rates of myocardial infarction and stroke with increased calcium intake by some authors, however, others described no effects or even beneficial outcomes.

We present a review of the current literature which provides a balanced summary of the possible beneficial and adverse effects of calcium intake in postmenopausal women on cardiovascular parameters. Taking into account the modest effect of calcium supplementation in reducing fracture rates, a reassessment of the role, benefits and adverse effects of calcium supplements should be conducted in postmenopausal women.

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Contents

1. Background	2
2. General population – other population groups	2
2.1. Women 19–50 years old (excl. pregnant and postmenopausal)	2
2.2. Pregnant women	2
2.3. Men	2
2.4. Renal impairment	2
2.5. Reviews	2
2.5.1. Normotensives vs hypertensives	4
2.6. Others	4
3. Post-menopausal women	4
3.1. Effects of calcium on blood pressure	4
3.1.1. Neutral effects	4
3.1.2. Beneficial effects	4
3.1.3. Adverse effects	4
3.2. Effects of calcium on cardiovascular disease risk and cardiovascular events	5
3.2.1. Beneficial effects	5
3.2.2. Adverse effects	5
3.2.3. Neutral effects	5

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4. A note on parathyroid hormone	5
5. Conclusions	6
References	6

1. Background

The prevalence of osteoporosis is rising among postmenopausal women due to increasing life expectancy, higher percentages of women smokers, and reduction in activity and exercise [1,2].

Calcium supplements have therefore received a lot of attention due to their increasing use in the management of osteoporosis, where they have been shown to decelerate bone loss in both sexes and possibly reduce fracture rates [3,4].

Despite these positive benefits, there is ongoing controversy regarding the effects of calcium supplements on the cardiovascular (CV) system, such as blood pressure (BP), plasma cholesterol levels, ischemic heart disease (IHD), myocardial infarction (MI) and strokes. The findings are conflicting, with authors reporting beneficial, negative or no effects [5–9].

Table 1 shows the proposed mechanisms of action of calcium on CV risk factors [10–14].

It is worth noting that calcium is evaluated in association with its closely related vitamin D in a considerable number of studies, however this review is exclusively dedicated to the former, as vitamin D has been suggested to have its own independent mechanisms on the CV system and thus any study examining vitamin D either on its own or in combination with calcium has been excluded [15–17].

The aim of this report is to review the current literature in the field and provide a balanced summary of the possible beneficial and adverse effects of calcium intake on the CV system in postmenopausal females. A summary of key findings is shown in Table 2 [5–8,12,18–25].

2. General population – other population groups

Before analyzing the effects of calcium intake in postmenopausal women, a brief discussion of the most recent literature on its effects on the CV system of wider age groups or other specific population groups is worthwhile.

2.1. Women 19–50 years old (excl. pregnant and postmenopausal)

According to the large systematic review by Chung et al., normotensive women in this age group were not affected by

Table 1

The proposed biological effects of increased calcium intake on cardiovascular parameters. PTH: parathyroid hormone; RAAS: renin angiotensin aldosterone system [10–14].

Parameter	Mechanism of action
Blood pressure	<ul style="list-style-type: none"> • Anti-pressor effects by inhibiting PTH and vitamin D • Natriuretic effect • Effect on RAAS (possible downregulation) • Membrane-stabilising/vasorelaxing effects • Interacts with sympathetic system (possible downregulation)
Serum lipids	<ul style="list-style-type: none"> • Promotes lipolysis and inhibits lipogenesis by reducing intracellular calcium (by suppressing calcitropic hormones) • Lowers cholesterol by increasing the excretion of bile salts
Cardiovascular events	<ul style="list-style-type: none"> • Accelerates vascular and valvular calcification

calcium intake in the studies reviewed, whereas those with hypertension benefitted, with reductions between 2 and 4 mm Hg in SBP. Subgroup analyses revealed that those in the lowest quintiles of calcium intake may have an increased risk of developing hypertension at a younger age compared to subjects in the highest quintiles [26].

With regards to CVA occurrence, Iso and colleagues concluded that low calcium intake may play an adverse role [27].

2.2. Pregnant women

Among those reporting beneficial properties of calcium was the study by Hofmeyr and colleagues, who reviewed randomized trials of calcium versus placebo in pregnancy, and found that calcium supplementation approximately halved the risk of pre-eclampsia (associated with hypertension) [28].

In their large meta-analysis of systematic reviews and RCTs, Chung and colleagues found that calcium supplementation in pregnancy may prevent pre-eclampsia and contribute to the treatment of hypertension with or without proteinuria, whilst subgroup analysis revealed that the effects of calcium seem to be greater in women at high risk of hypertension versus those at low risk [26].

2.3. Men

Specifically in men, Reid et al. recently reported no significant benefits of calcium supplementation on serum lipids or BP in a 2 year study period, during which 2 different doses of calcium or placebo were administered to healthy older men. However, borderline treatment effects were noted on SBP and diastolic BP in those with dietary calcium intake less than the median (785 mg/day) [29].

In their large cohort study, Xiao et al. found out that calcium supplements were positively associated with an increased risk of heart disease death in men at statistical significance but not cerebrovascular disease death, while Chung et al., in their systematic review, reported no significant effects of calcium intake on the BP of men in general [7,26].

2.4. Renal impairment

With regards to patients with renal impairment, it is already accepted that calcium supplementation elevates the risk for vascular events, even in those not requiring dialysis [30].

Moor et al. showed that pulse wave velocity (reflecting arterial stiffness) is significantly related to plasma ionized calcium in a positive fashion independently of BP, heart rate or ultra-filtration rate in 15 patients with end-stage renal disease [31].

Similarly, Russo et al., described a rapidly progressive increase in coronary artery calcification in 90 pre-dialysis subjects with calcium-containing phosphate binders, compared to non-calcium containing phosphate binders [32].

2.5. Reviews

Uusi-Rasi et al., in their recent systematic review, assessing and evaluating research in the relevant topic, (from 2000 to 2011), were

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